CLAIMS

1. A blue phase liquid crystalline material comprising a mixture comprising at least one bimesogenic compound and at least one chiral compound, wherein the material is capable of stable existence in the blue phase over a temperature range of at least 5°C.

2. The blue phase liquid crystalline material according to claim 1, wherein the mixture comprises at least two bimesogenic nematic compounds and at least one chiral compound.

3. The blue phase liquid crystalline material according to claims 1 or 2, wherein each bimesogenic nematic compound has the formula M-A-M', wherein A is a flexible chemical linkage and each of M and M'is a mesogen comprising at least 2 aromatic, heterocyclic or cycloaliphatic nuclei joined by a linkage which is more rigid than the flexible chemical linkage A.

4. The blue phase liquid crystalline material according to any of claims 1 to 3, wherein the bimesogenic compound includes at least one compound containing a chromophore.

5. The blue phase liquid crystalline material according to any of claims 1 to 4, wherein the chiral compound is a chiral nematic compound.

6. The blue phase liquid crystalline material according to any of claims 1 to 5, wherein the chiral compound has a helical twisting power in the range 20 to 100μm^{-1}

7. The blue phase liquid crystalline material according to any of claims 1 to 6, wherein the chiral compound forms 1 to 10% by weight of the liquid crystalline material.

8. The blue phase liquid crystalline material according to any of claims 1 to 7, wherein the helical twisting power of the chiral compound multiplied by the proportion in which it is present in the mixture is in the range 3 to 5 μm^{-1}

9. The blue phase liquid crystalline material according to any of claims 1 to 8, wherein the material is capable of stable existence in the blue phase over a temperature range of at least 35 °C and which is capable of stable existence in the blue phase at a temperature below 35 °C.

10. A process for the preparation of a blue phase liquid crystalline material which is capable of stable existence in the blue phase over a temperature range of at least 5 °C, the process comprising cooling a mixture of at least one bimesogenic compound and at least one chiral compound from the isotropic state.

11. A process for the preparation of a blue phase liquid crystalline material which is capable of stable existence in the blue phase over a temperature range of at least 5 °C, the process comprising cooling a bimesogenic chiral compound from the isotropic state.

12. A blue phase liquid crystalline material produced by the process according to claims 10 or 11.

13. An optical device comprising a layer of blue phase liquid crystalline material according to any of claims 1 to 9 or 12 enclosed between opposed carrier plates, an AC voltage source operationally connected to the carrier plates and a light source positioned to impinge a beam of light onto the layer of blue phase liquid crystalline material in a direction substantially normal to the plates.

14. A process of mirrorless lasing comprising subjecting a blue phase liquid crystalline material according to any of claims 1 to 9 or 12 to high energy pulsed radiation at a wavelength in the visible spectrum.

15. A slotted monolithic optical waveguide comprising an electro-optically active material positioned in a slot between two portions of the waveguide and electrodes deployed above the slot to adjust the phase of light travelling in the waveguide, wherein the electro-optically active material is a blue phase liquid crystalline according to any of claims 1 to 9 or 12.